

Claims

[c1] 1. A device for detecting faults due to permanent magnet degradation in a motor in a vehicle comprising:
a permanent magnet induced voltage monitor that measures a detected permanent magnet induced voltage of the motor at a predetermined speed; and a processor that:
compares the detected permanent magnet induced voltage with a reference voltage that reflects a permanent magnet induced voltage of the motor with a fully magnetized permanent magnet at the predetermined speed; and analyzes the detected permanent magnet induced voltage with reference to the reference voltage to determine whether a characteristic of the detected permanent magnet induced voltage indicates a component of the motor is faulty.

[c2] 2. The device of claim 1 wherein the permanent magnet induced voltage monitor comprises coils on a stator of the motor and a voltmeter coupled to the coils to detect the detected permanent magnet induced voltage.

[c3] 3. The device of claim 1 wherein the processor analyzes the detected permanent magnet induced voltage with reference to a point of synchronization that relates to a position of a permanent magnet in the motor.

[c4] 4. The device of claim 3 wherein the point of synchronization is caused by a predetermined irregularity in the motor.

[c5] 5. The device of claim 4 wherein the predetermined irregularity is formed in one of a rotor and a permanent magnet.

[c6] 6. The device of claim 3 wherein the point of synchronization is caused by a predetermined change in one of motor reluctance and magnetic strength.

[c7] 7. A method for identifying a component that is faulty and causing permanent magnet degradation in a motor of a vehicle, the method comprising the steps of:
detecting a first signal that is a function of permanent magnetization of a plurality of permanent magnets in the motor;

comparing the first signal with a reference signal that represents a function of permanent magnetization of the plurality of magnets in the motor, wherein the reference signal reflects a level of magnetization that is expected where the plurality of permanent magnets in the motor are fully magnetized; and analyzing a difference between the first signal and the reference signal to determine a faulty component that is likely causing the difference.

- [c8] 8.The method of claim 7 further comprising the step of:
setting a diagnostic code indicating the faulty component.
- [c9] 9.The method of claim 7 wherein the first signal is a permanent magnet induced voltage and the reference signal is a permanent magnet induced voltage.
- [c10] 10.The method of claim 7 wherein the first signal includes a point of synchronization and the reference signal includes a point of synchronization.
- [c11] 11.The method of claim 10 wherein the point of synchronization of the first signal is determined by a predetermined irregularity in the motor.
- [c12] 12.The method of claim 11 wherein the predetermined irregularity causes a change in one of motor reluctance and magnetic strength.
- [c13] 13.The method of claim 9 wherein the first signal is detected by inducing a voltage in a coil adjacent a stator of the motor.
- [c14] 14.A device for identifying a component that is faulty and causing permanent magnet degradation in a motor of a vehicle, the device comprising:
a processor that:
receives a first signal that is a function of permanent magnetization of a plurality of permanent magnets in the motor;
compares the first signal with a reference signal that represents a function of permanent magnetization of the plurality of magnets in the motor, wherein the reference signal reflects a level of magnetization that is expected where the plurality of permanent magnets in the motor are fully magnetized;
analyzes a difference between the first signal and the reference signal to determine a faulty component that is likely causing the difference.

- [c15] 15.The device of claim 14 further comprising the processor setting a diagnostic code indicating the faulty component.
- [c16] 16.The device of claim 14 wherein the first signal is a permanent magnet induced voltage and the reference signal is a permanent magnet induced voltage.
- [c17] 17.The device of claim 14 wherein the first signal includes a point of synchronization and the reference signal includes a point of synchronization.
- [c18] 18.The device of claim 17 wherein the point of synchronization of the first signal is determined by a predetermined irregularity in the motor.
- [c19] 19.The device of claim 18 wherein the predetermined irregularity is formed in one of a rotor and a permanent magnet of the plurality of permanent magnets.
- [c20] 20.The device of claim 16 wherein the first signal is detected by inducing a voltage in a coil adjacent a stator of the motor.